First capture of a coelacanth, *Latimeria chalumnae* Smith, 1939 (Pisces: Latimeriidae), off Kenya

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Fig. 1. The large female coelacanth (170 cm TL, 77 kg) caught at Malindi off the coast of Kenya on 26 April 2001.

ON THURSDAY 26 APRIL 2001, AROUND noon, Captain Suleiman Fahli of the trawler MV *Venture II*, owned by Basta Allessandro, hauled in a large female coelacanth (*Latimeria chalumnae*) from the western Indian Ocean off Malindi, Kenya (Fig. 1). The fish was caught in a trawl net of 2-inch (50 mm) mesh size that was targeting deep-water prawns. The exact site of capture was 7 nautical miles (about 13 km) offshore (03°14′ S, 40°14′ E) at a depth of 185 m (Fig. 2). According to Fahli, the fish was very active at the time of capture and bluish in colour. The fishermen wisely decided to keep the specimen because of its uniqueness.

It was stored at about –18°C in a deep-freeze at Wanainchi Marine Products, a fish processing company, in Mombasa. The details of the capture of this first (authenticated) record were obtained from Captain Fahli through the intervention of Charles Oduol (Area Director of Fisheries, coastal region). The latter was informed about the catch by Hakim Tung of Wanainchi Marine Products. After a few weeks, Tung removed some red muscle and a few scales from the fish and sent them in absolute alcohol to the *Jago* team at the Max Planck Institute of Seewiesen, Germany, for comparison with *Latimeria* samples from other localities.

In September, four months after its capture, the Malindi coelacanth was exhibited at the annual Mombasa Agricultural Show, where the President of Kenya, Daniel Arap Moi, who had officially opened the show, noticed the fish and decreed that it be properly preserved as part of the national heritage. As a result, Hassan Mohamed Hassan, an education officer at Fort Jesus Museum (Mombasa), informed Dalmas Oyugi, a research scientist in the Ichthyology Department of the Nairobi Museum, about the coelacanth. On 12 September, procedures to acquire the specimen for the museum were set in train by Oyugi, assisted by Oduol. The specimen was officially handed over to the National Museums of Kenya on 3 October and collected by museum staff Joseph Gathua and Michael Mburu, who brought the fish in a frozen condition to Nairobi. The fish was dissected the following day.

It is 170 cm in total length (TL) and weighs 77 kg. Morphometric and meristic data are given in Table 1 in terms of measurements indicated in Fig. 4. The abdominal cavity was opened by incision along the ventral midline of the body and the internal organs were examined and removed. The oviduct was large and contained 17 reddish eggs, 75–87 mm in diameter, weighing 115–274 g (n = 9). These eggs probably had not been fertilized (Fig. 3). The stomach was empty. After dissection, the fish was placed in a solution of 10% formalin. The liver, intestines, kidneys, gonads and other organs were kept frozen at –70°C.

Discussion

The Malindi specimen is further confirmation that coelacanths larger than 165 cm tend to be females.[1–3] A von Bertalanffy growth curve based on back-calculations of presumed annuli found on otoliths of *Latimeria chalumnae* by Musick *et al.*[4] suggested that the species grows very slowly, matures at about 27 years, and may attain a length of over 1.5 m at the age of 60 years. The 1.7-m-long Malindi specimen may thus be well over 50 years old.

The number (17) and size of the eggs found in the Kenyan fish are similar to the 19 mature (ovulated) eggs reported previously.[5,6] The egg diameters conform to previous records.

The Malindi coelacanth is particularly interesting. Most coelacanths have been collected from Grand Comoro and Anjouan, islands in the Comoros Archipelago. According to Hissmann *et al.*,[7] Grand Comoro hosts an estimated population of about 600 individuals. In October and November 2000, and in May 2001, a small, apparently viable population was observed at a depth of about 108 m in the Jesser Canyon at Sodwana Bay, off the

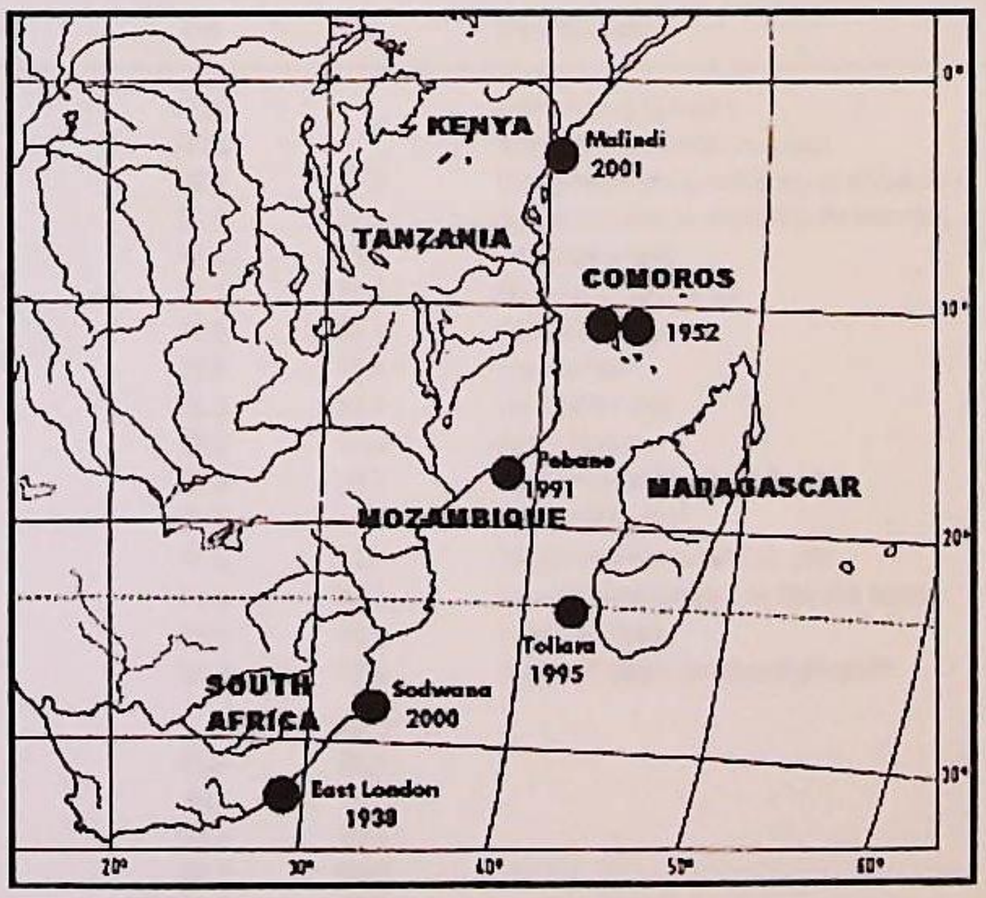

Fig. 2. Map showing the main localities and corresponding years of first authenticated records of coelacanth captures in the western Indian Ocean.

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Fig. 3 Views of some of the 17 eggs found in the Malindi coelacanth during dissection.

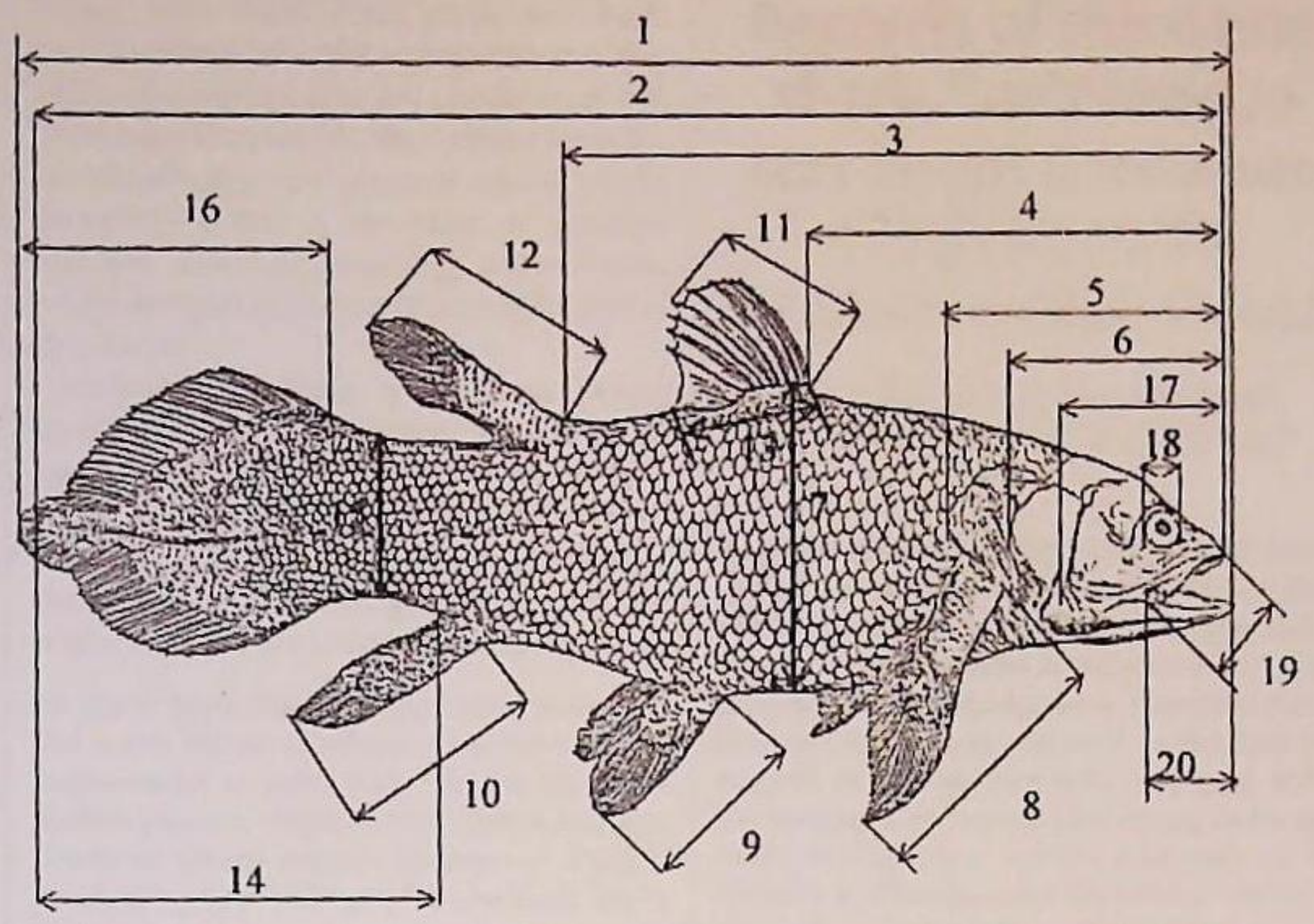

Fig. 4. Measurements 1–20 taken on the Malindi coelacanth: 1, Total length; 2, standard length; 3, second predorsal tenth; 4, first predorsal length; 5, head length 1; 6, head length 2; 7, body depth; 8, pectoral fin length; 9, pelvic fin length; 10, anal fin length; 11, length of dorsal fin 1; 12, length of dorsal fin 2; 13, base length of dorsal fin 1; 14, caudal peduncle length; 15, caudal peduncle depth; 16, caudal fin length; 17, preopercular distance; 18, eye diameter; 19, upper jaw length; 20, lower jaw length.

northeast coast of KwaZulu-Natal, South Africa.[8] During dives of the submersible *Jago* off Sodwana in March and April this year, 10 or 11 individuals were observed, indicating that the Sodwana coelacanths may not represent a large population, but probably are a resident breeding group (K. Hissmann, pers. comm.).

Single coelacanth specimens have been caught near the mouth of the Chalumna River near East London, South Africa;[9] off Mozambique over a sandy bottom northeast of Quelimane,[3] and off the southwest coast of Madagascar near Anakao (south of Toliara), over a predominantly sandy seafloor.[10] All these locations are south of the Comoros (Fig. 2); the isolated catches may be drifters transported by the strong Mozambique Current along the East African coast. The Malindi coelacanth is the first confirmed find north of the Comoro Islands. If it is a drifter from the Comoros, it may have been transported by the north-flowing East African Coastal Current, which is formed by the northward deflection of the Southern Equatorial Current when it strikes the East African mainland in southern Tanzania and northern Mozambique.[11,12] Alternatively, the presence of a coelacanth off the Kenyan coast might indicate populations living independently north of the Comoros. Other sporadic records of coelacanths along the coast of the western Indian Ocean and its islands increase the likelihood of independent populations.

Smith[13] reported a presumed catch of a coelacanth by a fisherman in the Bazaruto area of Mozambique as well as the possible sighting of a coelacanth over deep waters on a reef at Malindi in 1953 by a spearfishing tourist from Salisbury (now Harare). R. Stobbs (pers. comm.) men-

Table 1. Morphometric and meristic characters observed on the Malindi coelacanth. Measurements 1–20 are defined in Fig. 4.

Measurement	Body proportions	cm	%SL	Meristic counts	
1	Total length (TL)	170.0		Lateral line (LL) scales	99
2	Standard length (SL)	162.0		Scales around caudal peduncle	72
3	Second predorsal length	99.3	61.3	Scales between LL and origin of dorsal fin 1	10.5
4	First predorsal length	60.6	37.4	Scales between LL and pelvic fin insertion	11.5
5	Head length 1 (HL1, to posterior edge of fleshy opercular flap)	47.0	29.0	Predorsal scales	23
6	Head length 2 (HL2, to posterior bony edge of opercle)	37.0	22.8	Dorsal fin 1 spiny rays	8
7	Body depth	47.5	29.3	Dorsal fin 2 rays	28
8	Pectoral fin length	29.8	18.4	Anal fin rays	30
9	Pelvic fin length	25.0	15.4	Pectoral fin rays	29
10	Anal fin length	26.0	16.0	Pelvic fin rays	31
11	Length of dorsal fin 1	27.0	16.7	Superior (dorsal) caudal fin rays	24
12	Length of dorsal fin 2	27.5	17.0	Epicaudal fin rays	35
13	Base length dorsal fin 1	17.0	10.5	Inferior (ventral) caudal fin rays	24
14	Caudal peduncle length	54.6	33.7	Upper jaw teeth (row one and two each)	14
15	Caudal peduncle depth	24.6	15.2	Lower jaw teeth	8
16	Caudal fin length	32.0	19.8	Major gill rakers on second gill arch*	16
			%HL2		
17	Preopercular distance (to posterior edge of opercle)	25.7	69.5		
18	Eye diameter	5.0	13.5		
19	Upper jaw length	20.5	55.4		
20	Lower jaw length	20.1	54.3		
21	Mouth width (greatest distance between both extremities of lips)	17.2	46.5		
22	Interocular width (shortest distance between the skin around both eyes)	11.9	32.2		

*Major gill rakers are teeth-like. Other, minute gill rakers were not taken into account.

tions a non-confirmed catch at Mafia Island (Tanzania) in the late 1990s as well as of three additional specimens caught since 1995 in deep-set shark nets near Toliara, southwest Madagascar. Other unproven but reliable records noted by Stobbs include two accounts of sightings off northeastern Madagascar, a further two northwest of the island near Nose Be; one in the late 1950s at Astove Island; and two more off central and central-south Mozambique. According to Fricke *et al.*,[14] the habitats along the east coast of Grand Comoro are generally unsuitable for coelacanths.

Does the Malindi specimen belong to a separate viable Kenyan population? The Kenyan coast may not provide a suitable habitat for coelacanths because most of the continental shelf is gently sloping, of a sedimentary nature[12] and devoid of the caves that are preferred by coelacanths. However, M. Lane informed us of cavernous limestone deposits off much of the Kenyan and Tanzanian coasts. Their thickness and presence at coelacanth depths (probably not as deep as 200 m) is, however, still uncertain since most of the shelf and shelf edge has not been well investigated and lacks detailed bathymetric mapping. The coral limestones along the Kenyan coast are quite different from the volcanic environment of the Comoros, but the latter is not a requirement for a coelacanth habitat as was seen at Sodwana. During the day coelacanths aggregate in small, non-aggressive groups in sheltered lava caves, on the evidence of observations at Grand Comoro.[14] Caves may therefore be a limiting factor for temporary or permanent residence. At night coelacanths leave the caves to hunt by drifting singly along the steep lava slopes. Such caves have been found at depths between 150 and 253 m, yet the fish's preferred depth for sheltering appears to be around 200 m at Grand Comoro.

Preliminary DNA analysis indicates that the Malindi coelacanth does not differ significantly from Comoran specimens (M. Schartl, pers. comm.). This suggests that the Kenyan fish was a lone individual that had drifted away from the Comoros. On the other hand, Stobbs (pers. comm.) notes that the DNA of all coelacanths from the western Indian Ocean so far studied is very similar, which implies that *Latimeria*'s DNA is relatively stable and conservative, and that only great geographical separation would show significant molecular differences. If the western Indian Ocean *Latimeria* are widely distributed and there are groups ranging from Kenya in the north to South Africa in the south, as well as around the islands of the southwestern ocean, these satellite groups may occasionally interbreed with individuals detached from the Comoros or other populations. So, although coelacanths are considered not to be migratory fishes, the *Latimeria* populations off the east coast of Africa might therefore retain a measure of genetic stability through roaming individuals, whether current-borne or through natural movement.

With new fishing techniques being developed and mounting pressure to catch stocks of deep-water fishes and crustaceans, it is likely that inadvertent catches will continue to reveal more information about the zoogeography of the coelacanths of the western Indian Ocean.

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Records of the white shark, *Carcharodon carcharias* (Linnaeus, 1758), from the western Indian Ocean

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WE PRESENT 22 RECORDS OF THE WHITE shark, *Carcharodon carcharias* (Linnaeus, 1758), from the western Indian Ocean. These include 17 records from southern and western Madagascar, two from Zanzibar, one from Kenya as well as the first two records of this species from Réunion. While the presence of the species seems to be sporadic in Zanzibar waters and rare in the vicinity of Réunion and Mauritius, the documented specimens from Madagascar suggest that *C. carcharias* is often present along the southern coast of the island during February and March. Large individuals could arrive here from South Africa after crossing cold currents in the Mozambique Channel.

Introduction

Information on the presence of the white shark, *Carcharodon carcharias* (Linnaeus, 1758), in the western Indian Ocean is scarce and, for the most part, records are limited to the South African coast of KwaZulu-Natal. It has been suggested that the range extends to southern Mozambique,[1] and some specimens have been reported from the Seychelles.[2–4] The first records from Mauritius, Zanzibar, Madagascar and Kenya have recently been reported.[5] The occurrence and abundance of *C. carcharias* in the different zones of this region still needs to be better defined. Here, we report records of the white shark from Madagascar, the Mozambique Channel, Kenya, Zanzibar and Réunion.

Materials and methods

We searched for data on white sharks from the eastern Indian Ocean in natural history museums, interviewed malacologists, dealers and collectors from the area, while two of us (M.Z. and G.V.G.) visited Zanzibar, Dar es Salaam, Mada-

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